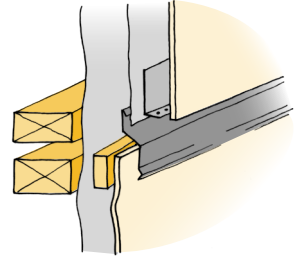
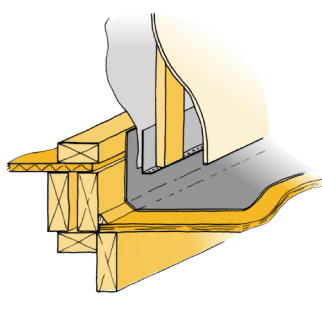
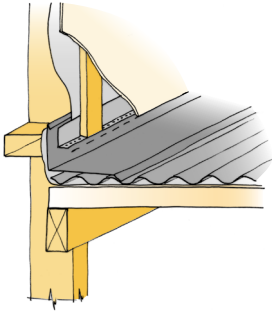




Department of
Building and Housing

Te Tari Kaupapa Whare



Constructing cavities for wall claddings

To be read in conjunction with
Acceptable Solution E2/AS1



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This booklet is based on the Acceptable Solution for Building Code Clause E2 External Moisture, E2/AS1 Third Edition, Erratum 1. If further amendments are made to E2/AS1, information in this booklet may become out of date.

The generic claddings shown in some of the figures in this booklet are indicative only. For specific cladding requirements refer to E2/AS1.

1.0 INTRODUCTION

This booklet is a guide to drained and vented cavity construction for timber-framed buildings, as described in the Acceptable Solution for Building Code Clause E2 External Moisture (E2/AS1). It does not explain the cavity behind masonry veneer wall claddings.

Drained and vented cavities (referred to in this booklet as 'cavities') are an important component of weathertight construction in higher-risk situations. Their proper construction is important to guard against the effects of leaking.

Cavities are not intended as a 'drain' down which water can be deliberately fed. Correctly installing the cladding is still the primary means of excluding water. Cavities act as a second line of defence to manage water that might inadvertently get past the cladding.

For timber-framed buildings in New Zealand, recent science and research has identified 'drainage' and 'drying' of water as critical functions of cavities. This booklet will help you construct cavities according to E2/AS1 to ensure buildings are well built and healthy.

For more information on materials, details and using common cladding materials, refer to E2/AS1. Copies of E2/AS1 are available to download free of charge from the Department of Building and Housing's website at www.dbh.govt.nz

2.0 WHAT DOES A CAVITY DO?

The cavity described in this booklet is intended as back-up protection if water leaks past the cladding.

A cavity constructed behind a cladding provides a method of managing water that might enter behind the cladding:

- through gaps or joins in the cladding
- around penetrations in the cladding, such as windows, doors or vents
- along the path of pipes, fixings or other elements that penetrate the cladding.

The cavity separates the cladding material from the timber framing. It protects the timber framing from any occasional leaking by providing a gap allowing water to drain down the back of the cladding and out through the base of the cavity. Any remaining moisture within the cavity is able to dry through ventilation provided along the bottom edge of the cavity.

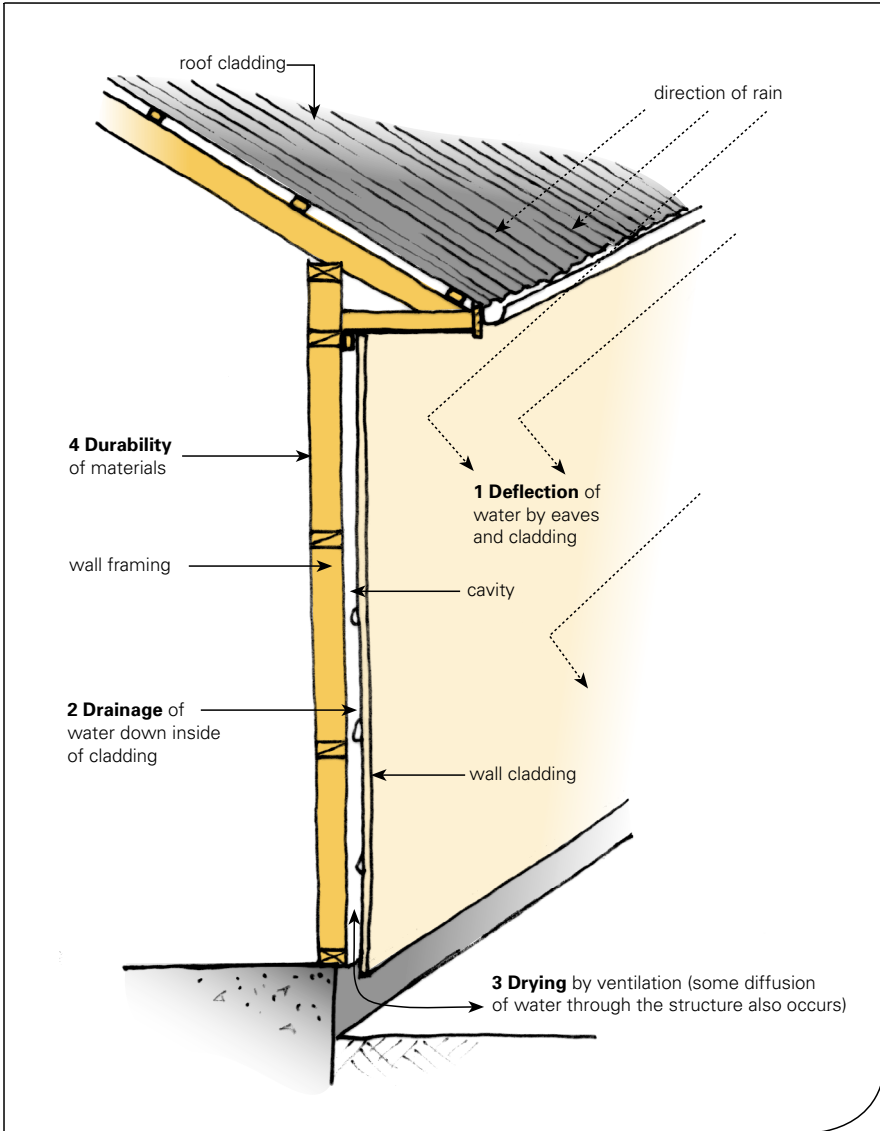
A masonry veneer cavity is different from the cavity described in this booklet. With masonry veneer cladding, it is expected that some water may pass through the masonry veneer itself, so the cavity is wider and has top as well as bottom venting. (For information on masonry veneer refer to E2/AS1 Paragraph 9.2.)

3.0 THE 4Ds

E2/AS1 is based on the '4Ds' of weathertightness (a concept developed in Canada). In this approach, 'Deflection', 'Drainage', 'Drying' and 'Durability' are the four key elements important to managing water on walls (see Figure 1).

- **Deflection:** The first line of defence is a well designed and constructed cladding system to 'deflect' the water away.
- **Drainage:** A cavity provides a second line of defence by 'draining' away water that may leak behind the cladding.
- **Drying:** By ventilating the cavity, any moisture that has not drained away is removed by 'drying'.
- **Durability:** Materials for wall and cavity construction must be sufficiently 'durable' to resist decay for a period that will allow time for a leak to be discovered and repaired.

Figure 1: The '4Ds' of weathertightness



4.0 WHEN IS A CAVITY NEEDED?

(Refer to E2/AS1 Paragraph 3.0.)

E2/AS1 contains a risk matrix that requires the designer to give a score to each wall face of a building. The score indicates the risk of water penetrating the cladding posed by the building design. With this score, the designer refers to a selection of claddings in Table 3 of E2/AS1 (some without a cavity, some with a cavity) and chooses an appropriate cladding system.

The designer includes the risk matrix score and calculations in building consent documentation, and details the cladding in accordance with E2/AS1.

You can download the guidance document *External moisture – A guide to using the risk matrix* for free from the Department's website (www.dbh.govt.nz) for more information on when a cavity is needed.

5.0 INSTALLING WALL UNDERLAYS

The wall underlay is either a **flexible wall underlay** (paper-based or synthetic) or a **rigid wall underlay** (plywood or fibre cement) in accordance with E2/AS1 Table 23 ('Properties of roof underlays and building wraps').

Install the wall underlay directly over the framing.

Install the cavity battens directly over the wall underlay as described in Cavity battens on page 9.

No additional wall underlay is needed between the wall cladding and the cavity battens except in the following situations.

- Metal claddings need a separation layer between the cladding and cavity battens containing copper-based treatment (refer to Timber cavity battens, page 9).
- Stucco on a non-rigid backing needs a flexible wall underlay as the non-rigid backing.

Fix wall underlay as follows to ensure water will be directed to the bottom of the cavity. Fitting the wall underlay correctly is essential, as the underlay helps form a second line of defence to protect the framing from moisture.

5.1 Flexible wall underlays

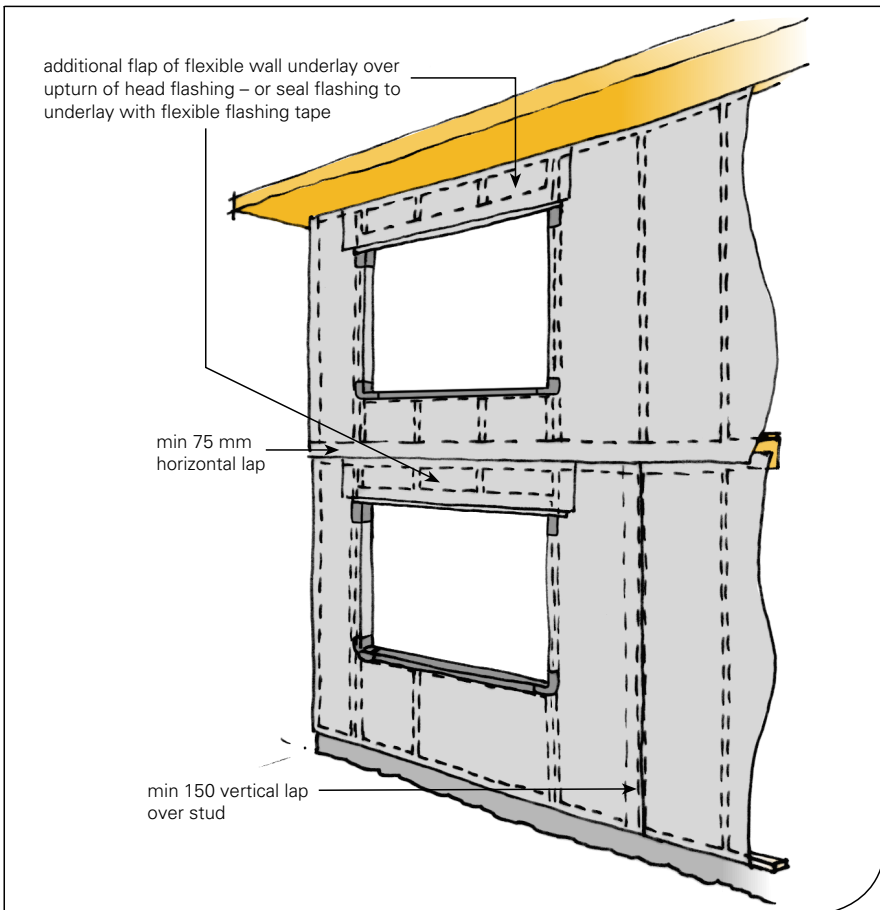
(Refer to Figure 2 and to E2/AS1 Paragraph 9.1.7.)

Run flexible underlays horizontally with the upper layer overlapping the lower by at least 75 mm. This will ensure the direction of laps sheds water to the outside.

At vertical joints in the flexible underlay, lap at least 150 mm over a stud.

Freshly LOSP-treated timber can affect bitumen used in some paper-based wall underlays. Ensure the solvent in timber framing or cavity battens has evaporated before placing wall underlay and timber in contact.

Figure 2: Fitting flexible underlay



At windows, doors and other openings, cut the flexible underlay and dress into all sides of the opening (see Figure 3).

Apply flexible flashing tape to fully cover the triangle of exposed framing at the corners of the head and sill. Extend the flexible flashing tape across the sill trimmer also (see Figure 4 and refer to E2/AS1 Paragraph 9.1.5). The flexible flashing tape at the sill does not need to be in three separate pieces as shown in Figure 4 – it can be a single piece.

Provide an additional flap of flexible underlay over the upstand of horizontal flashings that bridge the cavity, such as head flashings. Extend the flap of flexible underlay from under the top layer of the nearest lap above. Alternatively, seal flashings to flexible underlay with flexible flashing tape (see Figure 2 and refer to E2/AS1 Paragraph 9.1.10.4 c)).

Figure 3: Dressing flexible underlay around openings

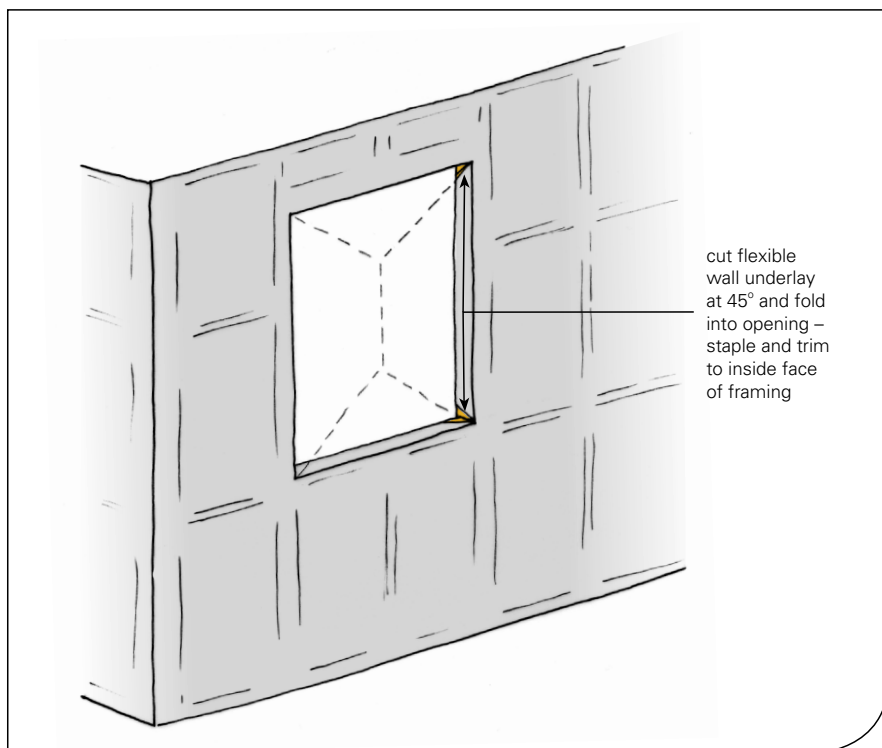
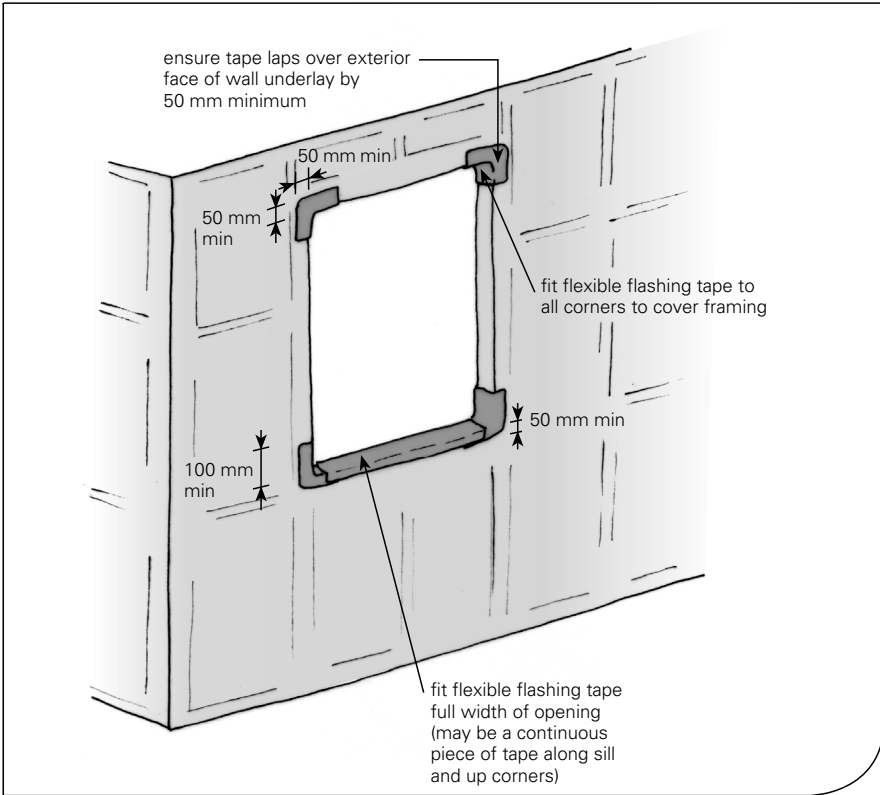


Figure 4: Taping corners and sill of openings

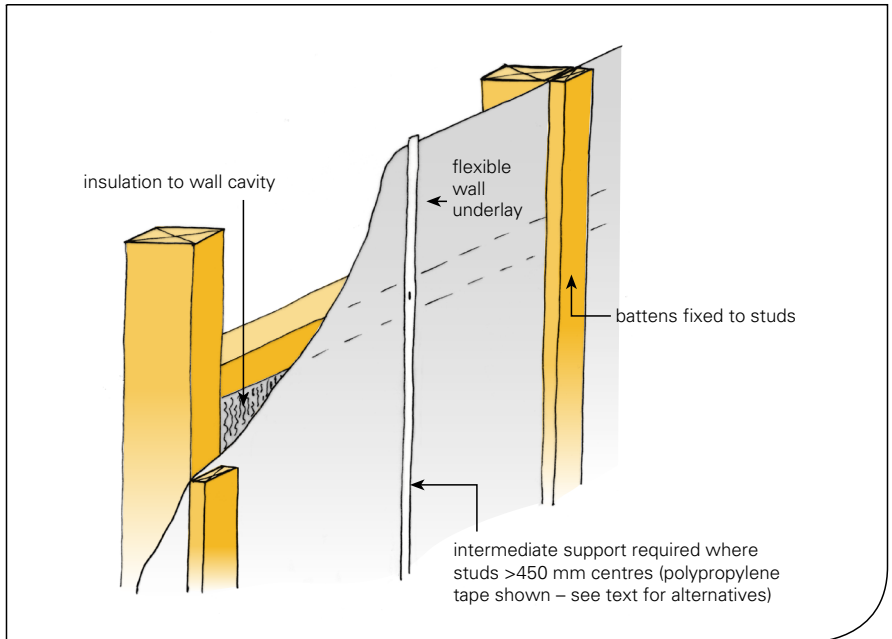


Fitting insulation into the wall framing (see Figure 5) may cause the flexible underlay to bulge and block the cavity. If studs are spaced at more than 450 mm centres, fit one of the following to prevent bulging of the flexible underlay.

- Polypropylene tape to provide maximum 300 mm spacings
- Extra battens to provide maximum 300 mm spacings
- Galvanised wire to provide maximum 300 mm spacings
- 75 mm galvanised mesh

(See Figure 5 and refer to E2/AS1 Paragraph 9.1.8.5.)

Figure 5: Intermediate support of flexible underlay



5.2 Rigid wall underlays

Fix rigid underlays so that vertical joints are made over studs and all horizontal joints are flashed with a z-flashing (metal, uPVC or butyl).

Seal horizontal flashings, such as head flashings, to the rigid underlay with flexible flashing tape or a flap of flexible underlay.

Install flexible flashing tape to the sill and the corners of the sill only (similar to the method described in Flexible wall underlays, page 5). Flexible flashing tape is not needed at the corners of the head of the opening for rigid underlays.

6.0 CAVITY BATTENS

(Refer to E2/AS1 Paragraph 9.1.8.4.)

Cavity battens may be either timber or polystyrene. The finished thickness of the cavity battens must be between 18 mm and 25 mm, and they must be at least 45 mm wide.

Timber cavity battens

Use radiata cavity battens of merchantable grade that are treated to a minimum of H3.1. Do not rip battens from larger members, as untreated timber may be exposed.

Most cavity battens are treated using LOSP treatment. However, if copper-based timber treatment is used, the batten must not be in contact with profiled metal wall claddings as this may lead to corrosion of the cladding (refer to E2/AS1 Paragraph 9.6.9.2). In these situations, place a separating layer between the batten and the cladding, such as:

- wall underlay (as per E2/AS1 Table 23)
- pre-priming of the cavity batten
- factory painting of the metal cladding (except in 'seaspray' and 'zone 1' corrosion zones – refer to E2/AS1 Table 21).

Polystyrene cavity battens

Use expanded polystyrene Class H or Class S or extruded polystyrene (for more information, refer to E2/AS1 Paragraph 9.9.3.1).

Vapour from freshly LOSP-treated timber may melt polystyrene battens. Ensure that LOSP solvents in framing or cladding have evaporated before installation.

6.1 Positioning battens

Support for vertical fixings

Fix vertical battens on stud lines. Vertical battening must be the full height of the cavity, but battens may be joined (butted) to achieve this.

Take account of where cladding fixings will be needed for the exact location of the battens. For example, at corners or cladding junctions, provide additional or wider battens as required for fixing the cladding, back-flashings or facings (refer to Figures 6 and 7).

Figure 6: Battens for external corners

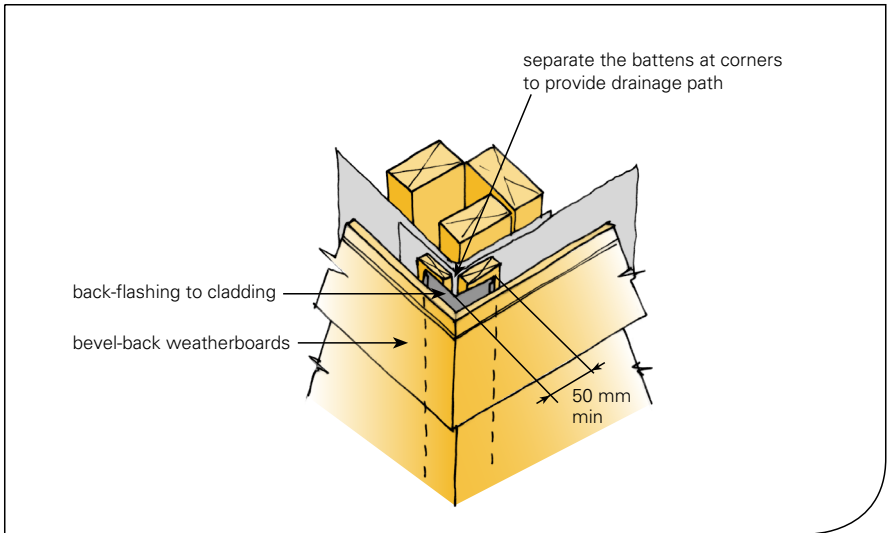
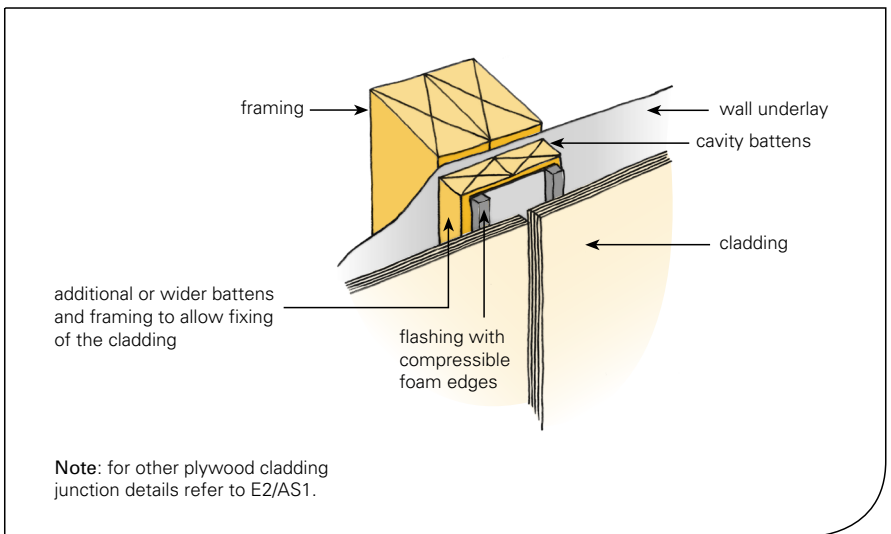


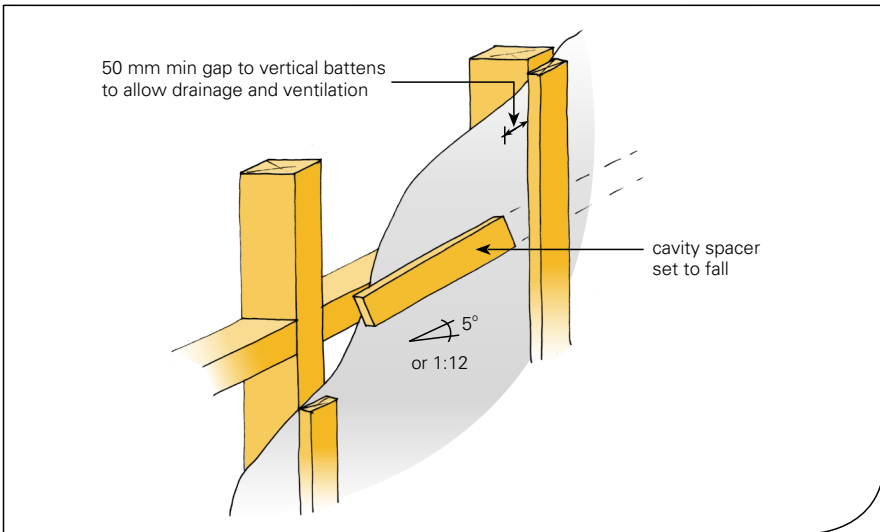
Figure 7: Battens for plywood cladding junctions



Support for horizontal fixings

Where an intermediate or horizontal fixing is required, for example to fix the top or bottom edge of sheet cladding, install a cavity spacer (short length of batten) on a minimum 5° slope. Leave a minimum 50 mm gap between the spacer and the vertical battens (the gap is to provide drainage and ventilation) (see Figures 8, 11 and 16).

Figure 8: Support for horizontal fixings



6.2 Fixing battens

Temporarily tack timber battens in place. Battens are permanently held by cladding fixings passing through them into the framing. Size cladding fixings to achieve a minimum 35 mm penetration into the framing. For more information on nail penetrations with particular claddings, refer to E2/AS1 Table 24.

Polystyrene battens may be temporarily glued to the wall underlay. Consult the manufacturer's instructions to ensure the glue is compatible with the wall underlay and the polystyrene.

BRANZ suggestion for alternative cavity batten fixing system

E2/AS1 Table 24 requires timber bevel-back weatherboards to be fixed using large (85 mm or 90 mm) nails to achieve sufficient penetration through the batten into the framing. As an alternative, BRANZ Limited has investigated structurally fixing the battens to the studs, which enables normal nail sizes to be used to fix the cladding.

For information on this alternative fixing method, E2/AS1 refers to Structural Test report ST0589 in 'comment' under Table 24. This information is now incorporated into *BRANZ Bulletin 475 Structurally Fixing Cavity Battens for Horizontal Timber Weatherboards*, available from August 2006. This Bulletin can be purchased from the BRANZ bookshop (call 0800 80 80 85 (Press 2) or visit www.branz.co.nz).

This alternative batten fixing system does not form part of E2/AS1. Therefore, it must be detailed and presented to the building consent authority as an alternative solution proposal to be assessed on a case-by-case basis.

7.0 CLOSING OFF THE TOP OF THE CAVITY

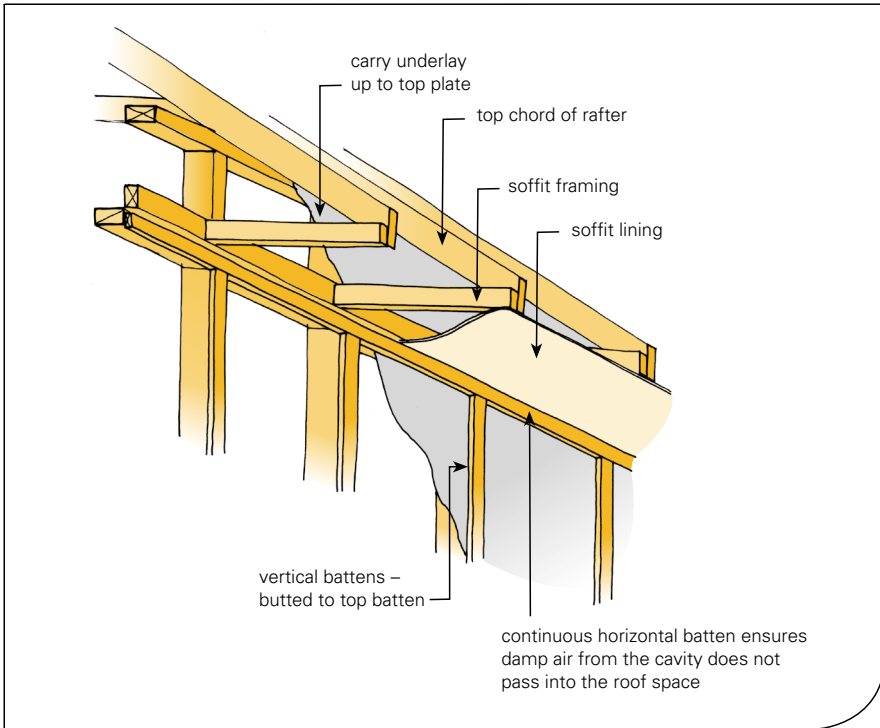
(Refer to Figure 9 and to E2/AS1 Paragraph 9.1.8.2 c.)

Ventilation is not required at the top of a cavity (note that masonry veneer uses a different cavity system that does require top ventilation – refer to Introduction, page 1).

Close off the top of the cavity to prevent damp air from the cavity getting into interior spaces, roof framing or eaves. This is particularly important where the cavity finishes beneath a soffit or other area that might be open to a roof space.

One way of closing off the top of the cavity is to use a continuous length of horizontal batten as shown in Figure 9. The horizontal batten also supports fixings at the top edge of sheet claddings where required.

Figure 9: Closing off the top of the cavity



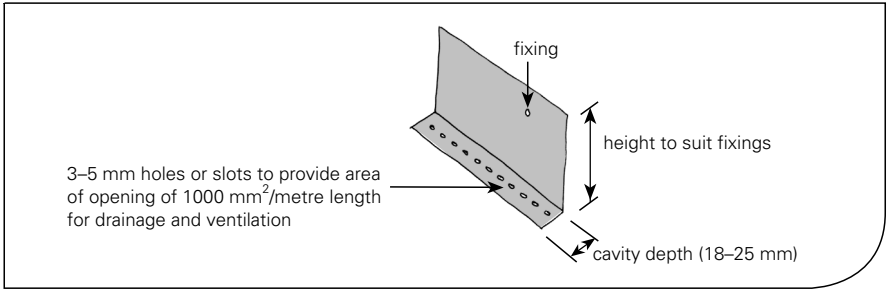
8.0 DRAINAGE AND VENTILATION

(Refer to E2/AS1 Paragraph 9.1.8.3.)

Allow drainage and ventilation at the bottom of the cavity. Fit a 'cavity closer' to the base of every cavity, allowing drainage and ventilation but preventing the entry of vermin (see Figure 10). This also applies where cavities occur over a window, door, roof or other interruption.

It is important to construct the cavity to exclude damp air from a subfloor space directly entering the cavity.

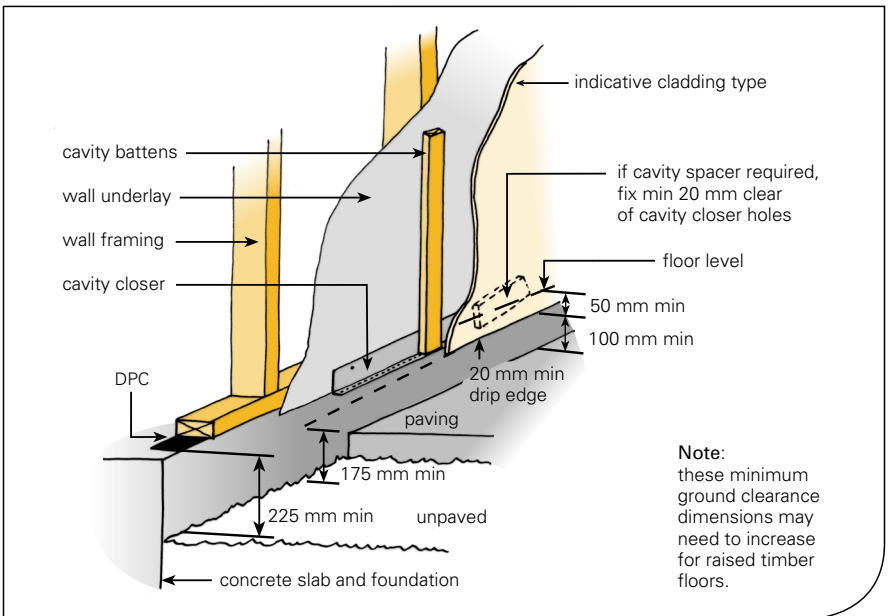
Figure 10: Cavity closer



Use a cavity closer made of a durable material such as aluminium, stainless steel or uPVC. It needs an upstand to allow it to be fixed to the framing, and drainage and ventilation slots or holes in the base. The slots or holes must have an opening of 3–5 mm and provide a total area of opening of 1000 mm² per metre length.

Provide a drip edge at the bottom of the cladding by positioning the cavity closer a minimum of 20 mm above the bottom edge of the cladding (this dimension can be reduced for specific cladding types – refer to E2/AS1).

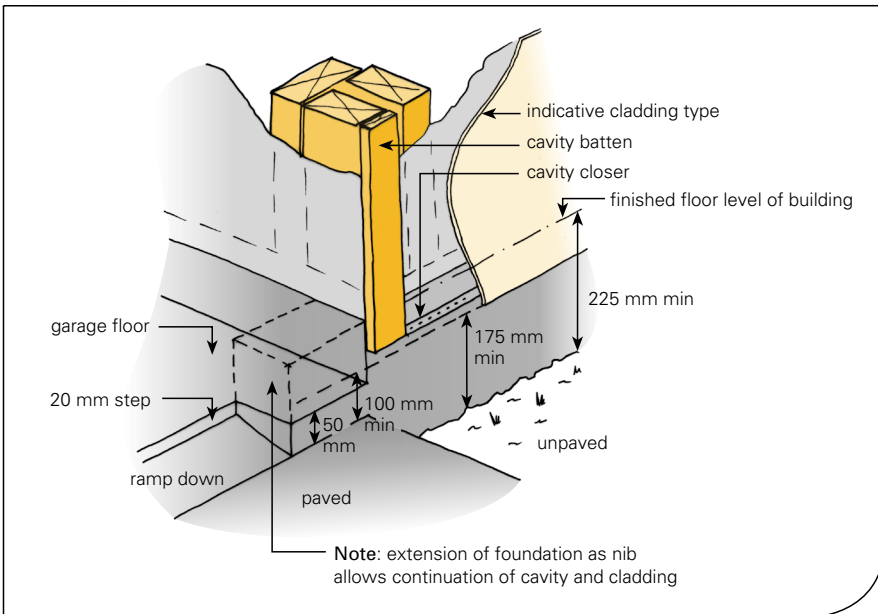
Figure 11: Drainage and ventilation at the base of the cavity



Garage floors need to be low enough to drive onto and high enough to provide a minimum 50 mm step-down to exterior paving, while maintaining cladding clearances either side of the garage door. To achieve this it may be necessary to construct the garage floor lower than the floor level of the building.

In these situations, providing a 'nib' at garage doorways (see Figure 12) allows the cladding to continue in a straight line while maintaining minimum clearances at the bottom of wall cavities for ventilation.

Figure 12. Garage clearances



At roofs or decks, finish the wall cladding a minimum of 35 mm above the surface of the roof or deck (see Figures 13 and 14).

Figure 13: Terminating the cavity over a membrane roof or deck

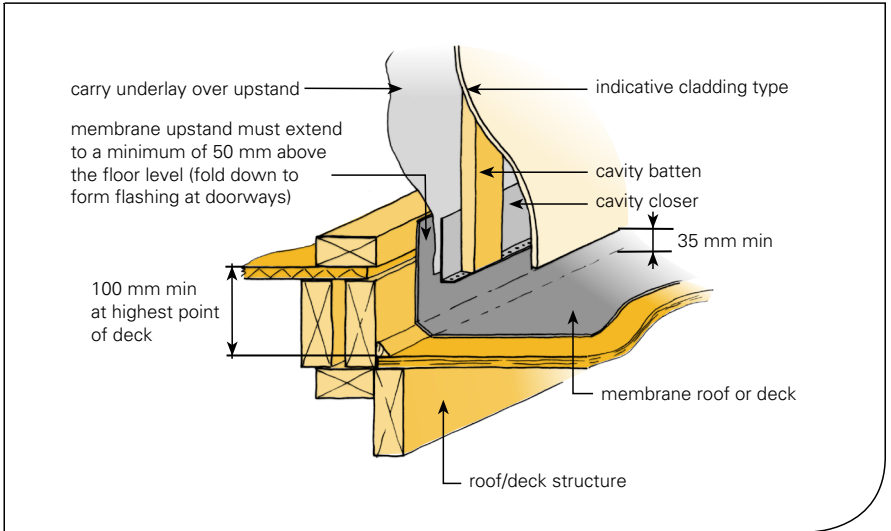
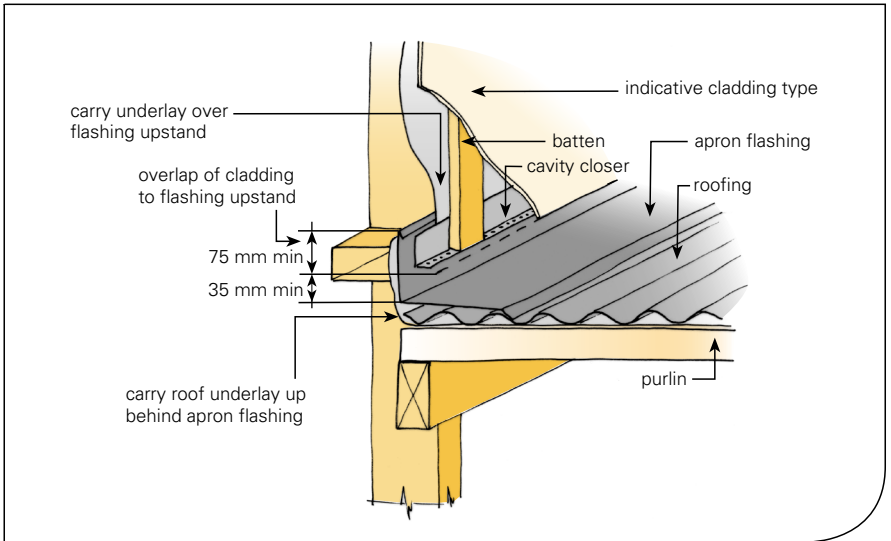


Figure 14: Terminating the cavity over a roof

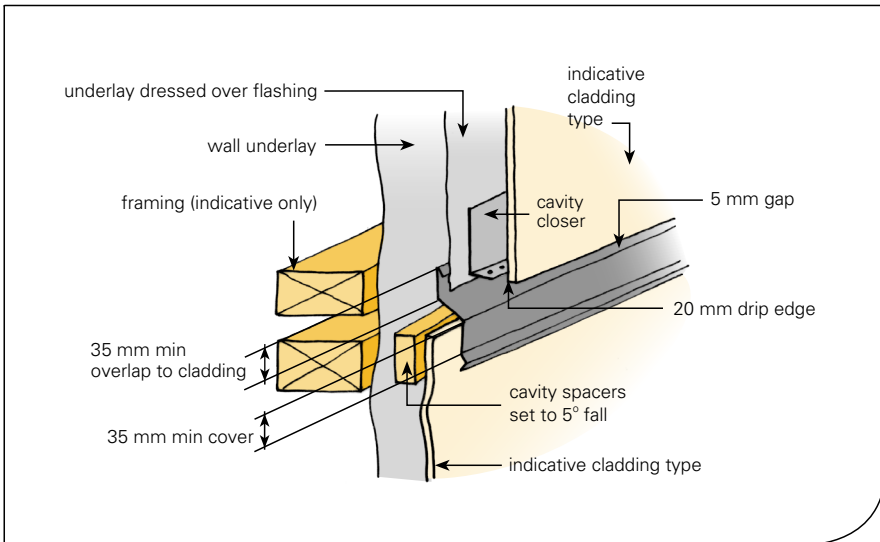


9.0 CAVITY WALLS OVER TWO STOREYS

(Refer to E2/AS1 Paragraph 9.1.9.4.)

Cavities may be continuous up to two storeys but not more, due to limits on drainage and drying. If the wall is greater than two storeys, divide the cavity using a horizontal flashing that bridges the cavity, as shown in Figure 15. Provide ventilation to the cavity above the junction, as described for the base of the wall.

Figure 15: Inter-storey cavity junction



10.0 INSTALLING WINDOW AND DOOR JOINERY

(Refer to E2/AS1 Paragraph 9.1.10.4.)

Fit windows and doors to the openings prepared as shown in Figures 16 and 17. For all window and door details, refer to Paragraph 9.0 of E2/AS1.

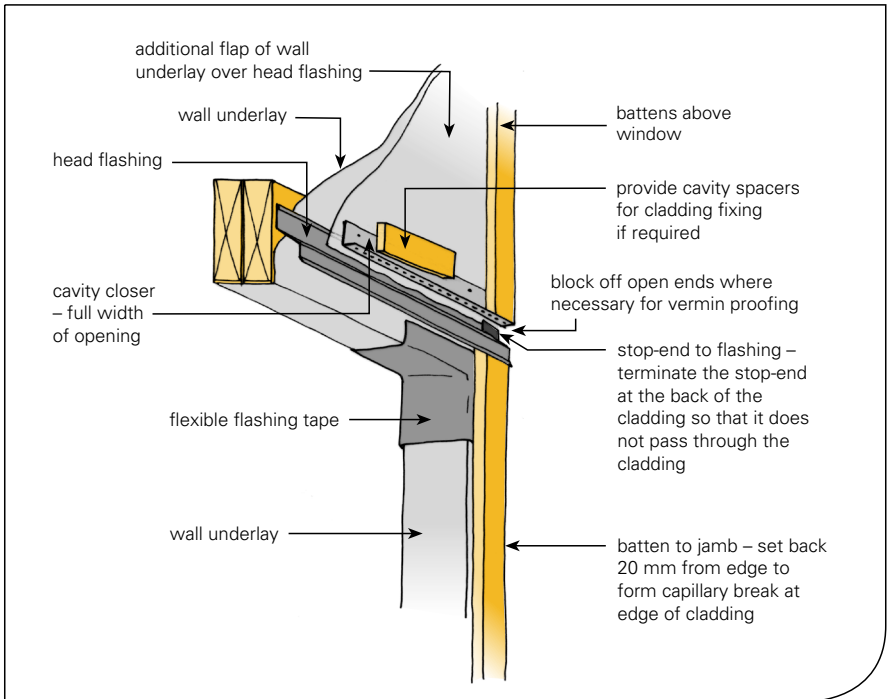
Install the head flashing and seal it to the wall underlay with flexible flashing tape or an additional flap of flexible wall underlay (refer to Figures 2 and 16). The head flashing must bridge the cavity so that any water that has leaked into the cavity above the window is directed to the outside.

Extend the head flashing a minimum 20 mm beyond the flange or scribe of the window or door at each side of the opening, and provide a 10 mm upturn as a stop-end. Terminate the stop-end at the back of the cladding so that it does not pass through the cladding and cause a further water-entry point.

Fit a cavity closer along the window or door head, ensuring a minimum 20 mm drip edge is created by the overhang of the bottom edge of the cladding (this dimension can be reduced for specific cladding types – refer to E2/AS1).

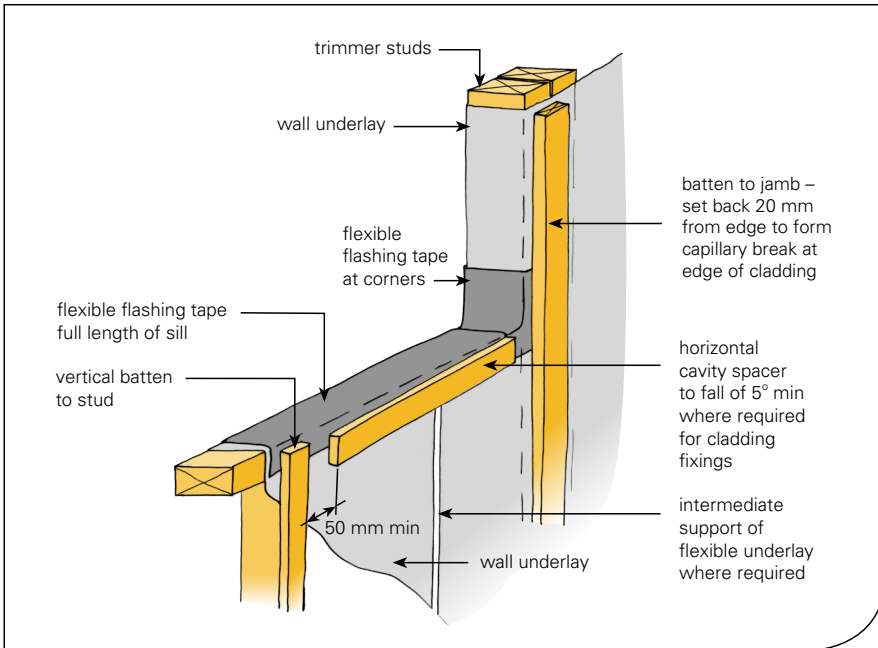
When installing the cladding, ensure the cavity above the window or door is ventilated by leaving a gap between the bottom edge of the cladding and the head flashing. The gap must be at least 5 mm to get an anti-capillary break.

Figure 16: The head of the opening ready for installing a window or door and cladding



Install cavity spacers where horizontal fixings are required (refer to Support for horizontal fixings, page 11).

Figure 17: The sill of the window opening ready for installing a window and cladding



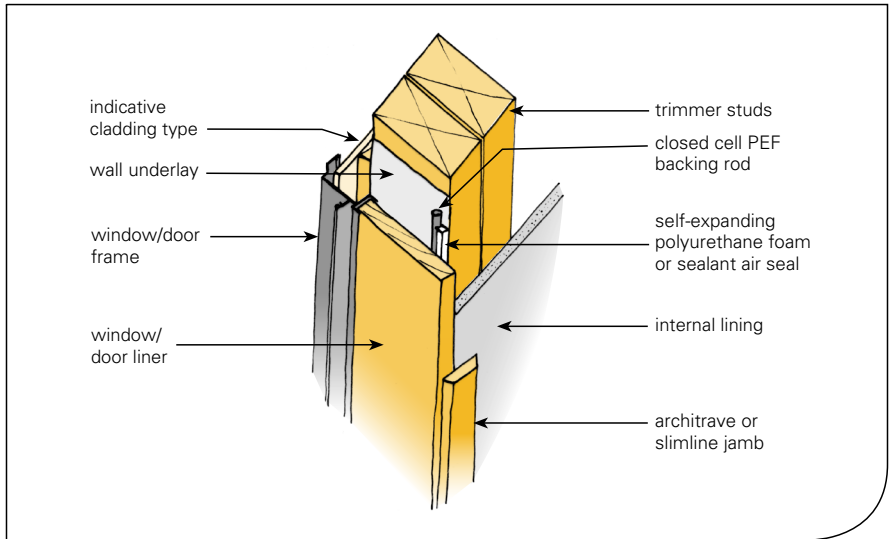
11.0 AIR SEALS

(Refer to E2/AS1 Paragraph 9.1.6.)

Seal the gaps between window and door frames or liners and the structural frame to prevent air flow between the joinery unit and the structural frame. This air seal must be on the interior (dry side of the opening). The same applies to openings formed by fixtures such as meterboxes (see Figure 18).

The air seal is to ensure variations in pressure between the exterior and interior of a building will not cause air flow through these junctions, as this can drag water in behind the cladding.

Figure 18: Installing an air seal



12.0 MORE INFORMATION

The Acceptable Solution for Building Code Clause E2 External Moisture (E2/AS1) is available to download free from the Department's website. Hard copies can be bought from Victoria University Bookcentre (phone 0800 370 370, or visit www.vicbooks.co.nz).

This document and *External moisture – A guide to using the risk matrix* can be downloaded free from the Department's website or call our freephone number for a hard copy.

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